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COMMENTS ON SOME PROBLEMS IN CONSTRUCTING DESCRIPTIVE, POLICY, AND DESIGN THEORIES OF FOREIGN POLICY BEHAVIOR

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VERY ROUGH DRAFT

COMMENTS ON SOME PROBLEMS IN CONSTRUCTING DESCRIPTIVE, POLICY, AND DESIGN THEORIES OF FOREIGN POLICY BEHAVIOR

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13. ABSTRACT

Three important purposes - description, policy, and design - of theories of foreign policy are examined. Problems in using existing theories to accomplish these objectives are delineated and suggestions for new modes of theory construction are offered.

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Foreign Policy						
Methodology						
Theory Construction						
Adaptation						

Introduction

Theories of foreign policy behavior--like theories of most anything else are developed with a variety of purposes. In this paper I want to discuss three such purposes. These are 1) description, 2) policy and 3) design. A discussion of these three is important since, as I will argue, the three are interrelated in various ways and it may well be helpful to construct theories with an awareness of some of these interrelations.

To make this argument, I must first clarify what I mean by a theory. Within political science (at least) the concept of a theory is one which takes on many meanings. To argue that one is more correct than others would be arrogant (and probably pointless). However, to assume that "everyone knows what a theory is" and thus not to define it is dangerous. Therefore, at the risk of appearing arrogant, let me make as precise as I can the way I will be using the term "theory."

Since this is a paper on the study of foreign policy and not on the definition of theory, I will attempt to accomplish this pre-task as briefly as possible. Probably the best way to achieve this is to identify some attributes of "theories" and then specify the exact set of attributes possessed by the things I'll be calling theories.

To begin, most all uses of theory agree that theories "exist" in languages. That is, they are sets of sentences. Thus one attribute of a theory is the kind of language (e.g., semantically closed or open, natural or artificial, etc.) in which it is expressed. Without arguing the point here, it should be noted that the kind of language chosen to express the theory has consequences for what can be asserted in the theory (i.e., it is generally not simply a matter of translating a theory from one language to another).

This leads to a second characteristic of theories--they assert something(s) to be true. A theory asserts that some state of affairs obtains, "Force is equal to mass times acceleration." Or, "variations in the structure of a nation are related to changes in the nation's external environment." When sentences such as the above two appear in a theory (e.g., the second is in Rosenau's adaptation theory). I want to be able to say that it is being asserted to be true. That theories assert the sentences which comprise them to be true would seem to be fairly unobjectionable (for an opposing position see Friedman (1953), or perhaps, by implication, McGowan (1973)). To see this, one need only consider the alternatives. First, one might argue that theories assert nothing whatsoever. But then why do theory? Theories are (intended to be) collections of propositions (i.e., a certain kind of sentence)--not collections of nonsense. Second, one might argue that only some (perhaps none) of the sentences in a theory are asserted to be true, the rest are asserted to be false (or perhaps assert nothing at all). In most of its forms, this second position is clearly absurd. Rather than consider the more coherent variant here, let me simply say that in this paper all the sentences in a theory will be considered to be asserted to be true.

Note that to assert a sentence to be true is not to make it true. Whether a particular sentence is accepted as true will depend in large part on ones epistimological and methodological positions. These questions will not be considered here.

Having restricted a theory to being a set of sentences (in some language) which are all asserted to be true, let me make one more distinction. In this paper, I will be considering two senses of theory--a technical one and a non-technical one. In its technical sense a theory is a set of sentences asserted to be true which is closed under deduction, that is, the set contains any sentence that is logically implied by any other sentence in the set. This concept requires some preassigned logical framework or "calculus axioms" (e.g., first-order predicate calculus). Any time we deal with an axiomatic theory, this technical sense is implied.

On the other hand, there is an important non-technical use of theory. A non-technical theory is simply a set of sentences asserted to be true. In this usage, no position is taken on the truth of any sentences "implied" by the theory sentences (indeed, "implied" may be undefined since no calculus axioms need be assigned the theory). Thus the entire body of knowledge about some subject may be referred to as the theory of that subject, as in "foreign policy theory." However, in this paper, unless otherwise specified, I will be using theory in its technical sense.

Having defined theory, it is important to provide a definition of a related and commonly encountered term--model. In very rough terms, a model is that "thing" which makes the sentences in a theory true. In theorizing we generally want to order or account for some aspects of a perceived reality. Thus we must first represent reality in terms of some posited objects and relations. Whether or not these posited objects and relations indeed represent reality is of course in many senses moot and is certainly contingent upon both our perceptual system and our ability to make and hold to distinctions.

However, a collection of objects and relations is a set theoretic structure and not a theory. We must write down some sentences describing (i.e., which are true of) this structure. These sentences I have termed a theory. The underlying structure I will call a model for that theory.

More specifically, a set-theoretic structure M is a set of elements (objects), $A = \{a_1, a_2, \ldots\}$, together with a set of relations of order i, $P_1^{i_1}, P_2^{i_2}, \ldots$, and may be expressed

$$M = \langle A; P_1^{i_1}, P_2^{i_2}, \ldots, P_n^{i_n}, \ldots \rangle .$$

A formal language L in which properties of M can be expressed will consist of formulas generated by a specified set of rules, say the predicate calculus, from an alphabet consisting of relation symbols (R_1, R_2, . . .), variable symbols (x_1, x_2, . . .), connectives ($\neg, \vee, \wedge$ . . .) and quantifiers ($\forall, \exists$). Since functions and constants are special kinds of relations, function symbols (f_1, f_2, . . .) and constant symbols (c_1, c_2, . . .) will also be used in L. The language L will be assumed to be first order, that is, its variables range over the elements of A (as opposed to ranging over the subsets of A, or sets of subsets, etc.). Sentences in L are formulas containing no free variables.

Let T be a set of axioms in a language L. If Φ is a mapping of constant symbols occurring in T into the set of objects A, and also a mapping of relation symbols occurring in T into the set of relations in M, then M provides an interpretation of T under Φ. If this interpretation results in the sentences in T being true, then M is said to satisfy T and M is a model of the axiom set T. A model for a set of axioms then, is a set-theoretical mathematical structure which interprets the axioms in such a way that the axioms are true.

One of the most obvious problems with the above definition of model is what is meant by a sentence being "true." Rather than provide an extended discussion of truth, the reader is referred to Tarski (1944). The important question here is not how do we know whether a particular sentence is in fact true but rather what is meant by asserting a sentence to be true. This latter semantic question is treated in considerable detail by Tarski for important classes of formal languages.*

A (abstract) system may be defined as a collection of objects together with the relations defined upon them (Ashby, 1952). This definition is, of course,

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* This discussion is taken from S. Thorson and J. Stever, "Classes of Models for Selected Axiomatic Theories of Choice" Polimetrics Laboratory Report, mimeo, 1973

the same as that given above for a mathematical structure. Thus it would seem that adopting a systems vocabulary for the ensuing discussion will not limit the range of theories which might be developed (or more precisely it will not limit the range of models we may theorize about).

From this perspective, a government (including the foreign policy making mechanism) might be viewed as an artificial system attempting to achieve various (perhaps poorly articulated and inconsistent) goals. At least part of these goals will have to be achieved in some outer (or task) environment. This outer environment may include domestic aspects of the "government's" nation as well as the rest of the "international system." Thus, I am arguing that a government can be viewed as a control mechanism and the rest of the world as the process being "controlled" by the government. This distinction immediately suggests several types of questions for the theorist. First, for particular nations, what do the inner and outer environments look like? Second, given an inner and outer environment, how can certain goals be "best" achieved? Third, given some set of objectives, what sorts of inner and/or outer environments can best achieve them? These are, of course, questions of description, policy, and design respectively. Since I will be arguing that these three may be ordered in the sense that answering policy questions will generally require having fairly good answers to the descriptive questions and that solutions to problems of political design will usually follow work in the policy area, I will treat each of these areas seperately moving from description through policy to design.

Description

I am using description here in a very general fashion to identify the standard concern in constructing scientific theory--to account for observations, to identify interrelations among them and to predict new observations. I do not mean to take any particular metaphysical position on the possibility of knowing any external world (i.e., have the "correct" description of it). Rather, my use of "description" is meant to be similar to that of Wittgenstein's"*

> "That Newtonian mechanics can be used to describe the world tells us nothing about the world. But this does tell us something--that is can be used to describe the world in the way in which we do in fact use it."

The correctness of a description is measured in terms of the adequacy of its consequences and not in terms of some "intrinsic" correspondence to what really is. Thus the task of developing a descriptive theory of foreign policy behavior involves constructing a set of sentences which orders (makes sense of) some set of observations of foreign policy behaviors and which can be used to predict future foreign policy behaviors.

In achieving this goal the theorist will, of course, have to work on the basis of some finite number of observations. With these observations, he will be attempting to identify the underlying structure which is generating these observations. And yet, as is well known, there are an infinite number of structures which could have generated the observed strings of behavior.

More specifically, to describe a system is to write sentences which relate values of some variables to values of others. Assuming the system (i.e. model) is an adequate representation of the referrent reality, these sentences (i.e., the theory) can be used to predict future states of the world. As an example, consider the abstract system of Figure 1.

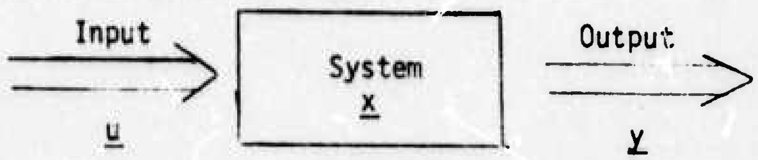

Figure 1

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* Tractatus 6.342 ff

The state of the system at any point in time is given by the vector $\underline{x}$.

A description of this system might consist of the following equations:

(i) $\dot{\underline{x}} = f(\underline{x},\underline{u})$

(ii) $\underline{y} = h(\underline{x},\underline{u})$

These equations assert that changes in the internal state ($\dot{x}$) is a function ($f(\cdot)$) of the state of the system ($\underline{x}$) and the input ($\underline{u}$) and that the output of the system ($\underline{y}$) is a second function ($h(\cdot)$) of the internal state and the input. This is important for looking at the overtime behavior of a system (in terms of its outputs) it is crucial to look at internal state changes as well as input-output changes. In other words, output behavior need not be a function (in the mathematical sense) of inputs. The same input can lead to different outputs if the internal state* of the system is different.

As a highly stylized example consider the behavior of a "bully" nation. Suppose it is capable of being in only two internal states--it either is stable (S) or unstable (~S). Further, it is capable of emitting and sensing only two sorts of behaviors--aggressive (A) and non-aggressive (~A). Thus we have:

u: (A,~A)

y: (A,~A)

x: (S,~S)

Since the nation is a bully, it will behave aggressively whenever it can. And, as everyone knows, the only time a bully does not aggress is when it is threatened and in a weak (in our terms unstable) state. Thus we can write $y = f(x,u)$ as in Table 1.

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* State here is being used in the sense of Ashby (1952) and not of Mesarovic (1970).

Table 1

Input (u)	State (x)	Output (y)
T	S	T
~T	S	T
T	~S	~T
~T	~S	T

As can be seen the output of the bully nation is entirely deterministic. Further, since even a bully gets nervous (and, therefore, unstable) when he is threatened, x = h(x,u) can be written as in Table 2.

Table 2

Input (u)	State (x)	New State (x)
A	S	~S
~A	S	~S
A	~S	S
~A	~S	~S

All this most likely seems both absurd and simple. However, further suppose a political scientist is watching the bully nation and trying to relate its behavior (outputs) to the behavior it receives (its input). What will he see?

First of all, he will generally ignore the internal system and simply relate inputs and outputs. Thus he might watch the bully over a long period of time and note that non-aggressive inputs always are followed by aggressive outputs on the part of the bully. However, he would note, threatening outputs are preceeded by threatening inputs only about one half of the time. Therefore, he writes an article in which he proclaims two general laws.

law (1) $P(y = A | u = \sim A) = 1$

law (2) $P(y = A | u = A) = 1/2$

Of course, by this time the world is getting rather sick of the bully's behavior and commissions our political scientists to recommend a policy toward the bully (this policy would consist of generating values of u). Given the two laws above, the optimal policy would, of course, be to always behave in an aggressive way toward the bully nation which would, according to law (2), guarantee that 1/2 of the bully's responses would be non-aggressive.

Note that our mythical political scientist, like so many of us, ignored the internal state of the bully nation. As a result, he was forced to state his laws in probabilistic terms and to conclude that the "best" that could be done was to reduce $p(y = T)$ to about one half.

However, by referring back to the transition tables, it can be seen that the bully can be made to act in a completely non-aggressive way. Suppose first he is initially in state $\sim S$. Then by always behaving in an aggressive way toward the bully, the bully will never respond in an aggressive way. If, on the other hand, he is initially in state S, then he will respond in an aggressive manner no matter what you do. However, by threatening him, you will force him into an unstable state and therefore continuing aggressive acts will result in no more threats from the bully. Thus, paying attention to internal states, it is possible to eliminate references to probabilities and to suggest a policy which will result in at most one aggressive behavior by the bully. While in this example ignoring internal structure did not result in "wrong" policy advice, it is possible to construct an example for which it would.*

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* For example, see Kanter and Thorson (1972).

The important point here is that in developing descriptive theories of foreign policy behavior, we must pay close attention to the internal structure of the foreign policy generating mechanism as well as to that of the international environment in which the mechanism is imbedded. Specifically, it would seem important to look more closely at foreign policy bureaucracies. Examples of relevant work here include Ellsberg (1972), Niskanen (1971), and Halperin and Kanter (1973).

Policy

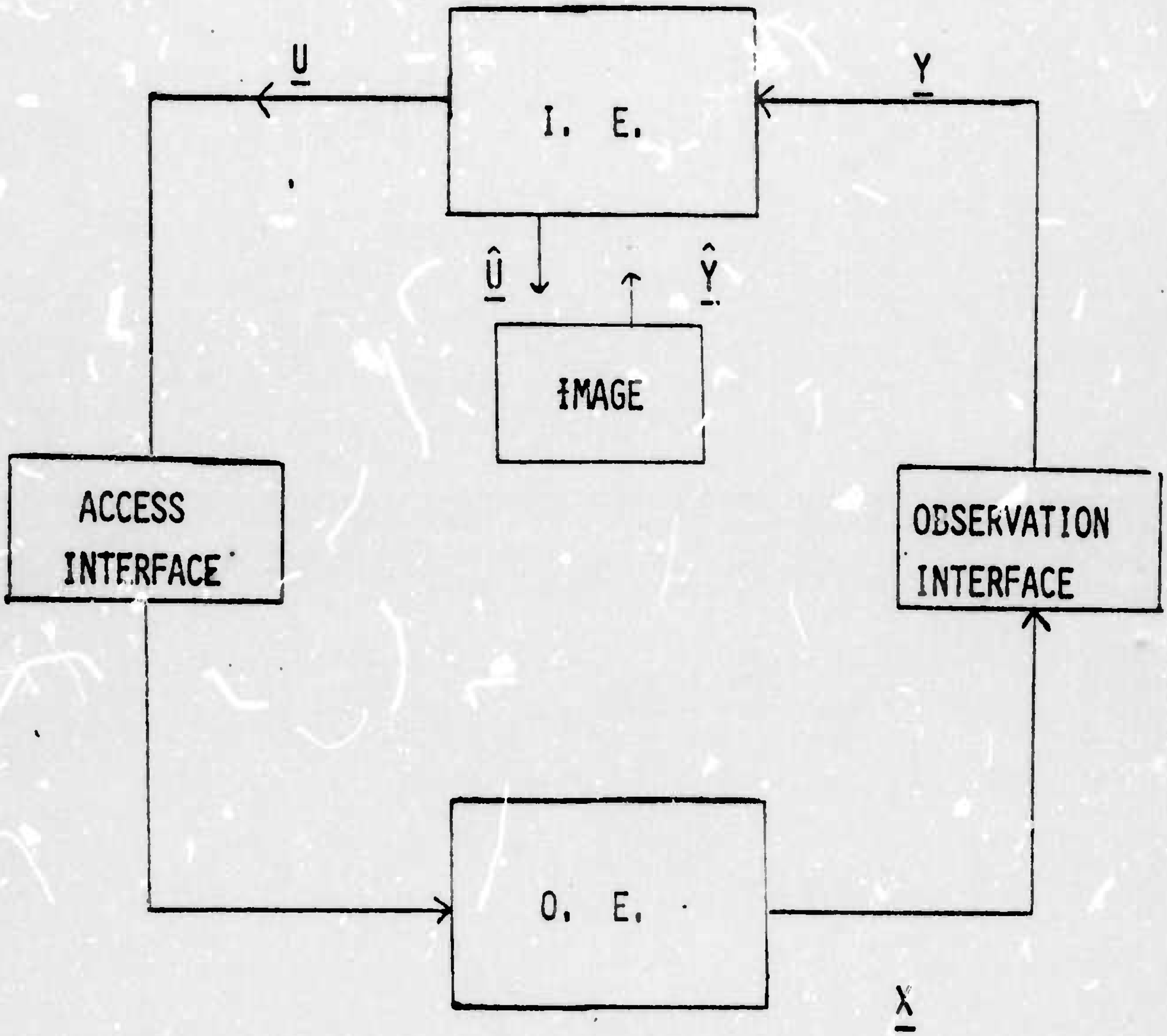
In the last section I alluded to the importance of descriptive theory in the making of policy recommendations (as well as in evaluating the impact of a policy). In order to make clear what I mean by a "policy," it is useful to return to the artificial systems structure of figure 2. The I.E. behaves in a way to maintain the states of the I.E. and the O.E. within some limits. These desired states can be termed goals of the I.E. in order to achieve its goals it sends outputs to the O.E.. These outputs of the I.E. are called the policies of the I.E..

If political scientists are going to be able to assist in consistently making "better" policy decisions, we must approach being able to do the following:

1) identify a set of feasible policies
2) identify the rules for linking policies to consequences
3) define a utility function over the various dimensions of the consequences
4) identify a rule for selecting a policy from (1) on the basis of (3).

Since the purpose of policies is to move the state of the entire system to some desired value (or set of values). It is important to recognize that goals are defined in terms of both the state of the I.E. and that of the O.E..

ARTIFICIAL SYSTEM STRUCTURE



This is different than the classical control problem where the goals is generally defined only in terms of the O.E..

Further, in order to identify the impact of a policy upon a system, it is necessary to first have a description of that system of the sort identified in the previous section. Such a theory will describe what happens when something is done to the system. But what can be done to the system? A U.S. President has many foreign policy options which are, in principle, open to him. In any particular instance, these may range from doing nothing to launching nuclear weapons. However, the options a President in principle has and those he considers are not generally the same. Constraints--be they political, economic, etc.--rule out certain policies. Those policies which meet the constraints are called feasible policies.

In making policy recommendations to a unit of government--be it a President or a desk officer--the first thing we must be able to identify is the set of feasible policy options. Notice too that constraints are often contingent upon the policy maker. It is feasible for the President to take actions not open to a desk officer (and conversely). Even the relatively simple task of identifying the constraints depends upon a good descriptive theory of the system. Policies which might be infeasible under one description may become feasible under a second. For example, it is doubtful that either Nixon or his critics desire increasing the risk of nuclear war. His mining of Haiphong Harbor was criticized for increasing that risk. Whether it did or did not increase the risk is, of course, dependent upon the particular descriptive theory being employed. The difference between Nixon and his critics may be viewed less as a disagreement about policy objectives and more as one over consequences of a particular policy. As we have seen, the predicted consequences depend upon the descriptive theory which is used to make the predictions.

Thus, the identification of feasible policies is not completely independent of the rules (i.e., the description) for linking policies to consequences. To do even the most simple part of policy analysis, adequate descriptive theory is required.

Having associated consequences with policies, we must then identify a utility function over their possible consequences. Such a function classically takes on scalar values. For example, consequences may be ordered purely in terms of their cost in U.S. dollars. In foreign policy applications it will not always be possible to define such a single valued utility function. The conditions under which a (real) single valued ordinal utility function exist are identified in Debreu (1954). It is a simple matter to show plausible situation (e.g. lexicographic orderings) which violate these conditions.

Therefore it will sometimes be necessary to look at multiple valued utility functions. This will be necessary, for example, when it is impossible to specify trade offs between dimensions of the consequences (as perhaps between "national security" and "international stability"). In such instances there are no general rules for ordering the consequences (for a survey of attempts see Roy (1971)). Which is bigger--the vector $\langle 9, 7 \rangle$ or the vector $\langle 6, 10 \rangle$? Thus a second problem we face in assisting in the making of foreign policy is dealing with multiple valued utility functions.

Even given a set of feasible policies and well behaved utility function over their possible consequences, the task of policy selection is not completed. Indeed the most important task remains. This is to define some sort of rule for selecting a policy given the utility function. Approaches to this question are reviewed in great detail by Chernoff (1954).

The point is that even if we know a particular actor's set of feasible alternatives and his utility function over their possible consequences, we still cannot advise him how he should act. This can be seen more clearly if I first define a particular (though not unrealistic) sort of decision problem (one in which the descriptive theory is probabilistic). First define a set U^f of feasible policy alternatives $u_1, u_2, \ldots u_n$. Second, define the set S as the set of possible system states $s_1, s_2, \ldots s_m$ for the O.E. and the I.E. of the artificial system. Clearly the goal states s_i^* belongs to S. Finally we let the utility function,* T, be defined over S and U^f. Thus we have T (u_j, s_i). This looks more like a traditional decision problem if risk is seen as negative utility yielding a risk function $r(u_j, s_i) = -T(u_j, s_i)$.

The decision rule most often encountered in political science is that of maximizing expected utility. This criterion is a useful one if it is possible to accurately assign probabilities to states of the world. Here the task is one of multiplying $T(u_j, s_i)$ by the probability (p_i) of s_i for all u_j, s_i and then selecting that u_j for which

$$\sum_{i=1}^{m} p_i u_j$$

is at a maximum.

As an example consider a situation where the descriptive theory yield three possible states of the system each of which is equally likely ($p_1 = p_2 = p_3 = 1/3$). Further there are two feasible policies u_1 and u_2. $T(u_j, s_i)$ are given as cell entrices in the following decision matrix:

	u_1	u_2
s_1	-30	30
s_2	3000	60
s_3	300	90

* This is a Von Neumann-Morgenstern utility function and is more restrictive than the ordinal utility index discussed by Debreu (1954).

The expected utility of u_1 is

$$1/3\ (-30) + 1/3\ (3000) + 1/3\ (300) = 1090$$

In like manner, the expected utility of u_2 is equal to 60. Under the maximize expected utility rule, policy u_2 ought to be enacted.

However this is not the only "reasonable" criterion which might be used. Another plausible one is to minimize your maximum risk. Remembering that risk is equal to negative utility, it can be seen that the maximum risk is obtained under u_1 (and is equal to 30). Thus the policy maker desiring to minimize maximum risk ought to enact u_2.*

There are many other equally plausible decision criteria which might be used. That there are such different functions is important since in risky or uncertain worlds, an actors' decisions cannot be predicted simply by knowing his feasible policies and the utility he attaches to their possible consequences.

It would be interesting to develop a classification of actors based, in part, upon the decision rule(s) they use in selecting foreign policy strategies. Perhaps, for example, leaders of nations with nuclear weapons would be more inclined to use a minimize maximum risk strategy than would leaders of other nations.

The importance of the decision rule being used cannot be overestimated. Even descriptive theories foreign policy decision-making are often dependent upon the particular rule being employed. Thus for example, a major source of disagreement between "quagmire" theories of U.S. involvement in Viet Nam (e.g., Schelsinger, 1968) and the stalemate theory of Ellsberg (1972) is over precisely the nature of the decision rule being employed.

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* Ferejohn and Fiorina (1972) provide a very nice discussion of these two senses of rationality and their impact on people's voting.

In this section I have attempted to sketch out some minimal theoretical things we should be able to do before we can be of much use in giving policy advice. Further, I have argued that all of these things are dependent upon good descriptive theory.

Design

Whereas a policy problem (or, alternatively a policy theory) is concerned with identifying and implementing feasible strategies to meet some goal(s) in accord with a particular decision rule(s), design problems deal with identifying and describing various mechanisms (e.g., inner environments, outer environments, and interfaces) for the achievement of goals. The distinction I am making here between policy and design is analogous to the distinction between the values of variables (including parameters) and their structure. Policy changes are changes in the level of variables and design changes are changes in the structure relating the variables. Thus increasing the rate of an existing tax would be a policy change while introducing a new tax would be a design change.

The design problem is often viewed in engineering terms (Simon, 1969), where the problem is to design an inner environment (or control mechanism) which can achieve goals (or control) in a particular outer or task environment (process). It is important to notice distinction between the typical engineering approach to design and that being taken here. In engineering the process (or outer environment) is taken to be a given. For example in designing an airplane, the "laws" of gravity are fixed. The air frame designer is not free to design new gravitational laws which will make it easier for his plane to fly. This is not always true in designing social systems. Oftentimes the structure of the outer environment itself can be changed. Indeed it is sometimes "easier" to change the O.E. structure than it is to change the levels of various variables.

More generally, a task of design theories might be seen as one of identifying various governmental systems (including, of course, foreign policy mechanisms) which are effective in achieving specified goals in various classes of outer environments. If viewed this way, important tasks to be accomplished include developing taxonomies of outer environments and types of goals.

In designing these inner environments, one area which requires additional research is the interfaces between a governmental system and its outer environment. The governmental system can be viewed as a hierarchical information processor. This information is used to select appropriate outputs (policies). Implicit here is the idea that responses are functions of previous information and the present system state.

In order to receive this information the government (inner environment) must have some sort of observation interface. This serves as a perceptual system and determines what aspects of the outer environment the government will have information about. The observation interface may be thought of as a sort of screen which may modify and certainly blocks out some of the information in the outer environment.

The importance of the kind of perceptual screen used by the government is illustrated by the work in designing algorithms by which computers can play chess. The game of chess has been of special interest to workers in artificial intelligence for many reasons. First there has always been an aura of mystique about the game. To play the game at all, many people feel, requires a certain degree of intelligence and to play it at the level of the grandmaster requires real genius. Second, while chess is a complex game, the rules describing allowable moves are well understood. Third, the large number of possible moves creates the problem of sorting out relevant and irrelevant information. Fourth, since chess moves are made according to a well-defined sequence, the game is especially tractable for playing on the computer. Last, it is felt that the principles necessary to the playing a good game of chess are similar to the principles necessary for dealing with other real world problems such as management and planning.

Shannon (1950) first identified the two approaches chess playing algorithms might take:

1. Scan all possible moves and construct a decision tree of equal length for each move (length here refers to the number of moves into the future the program scans). Then, using some weighting function the possible moves can be evaluated and the best one chosen.
2. Scan only certain moves. Eliminate others through the use of some special rule.

The first approach requires the computer to view the chess board in all its complexity. Very valuable information is treated the same as more unimportant information. The price of this synoptic approach is that, for a given memory size, the number of moves into the future that are looked at is severely limited. Much memory is wasted looking at trivial information. The second approach trys to avoid this problem. By pre-excluding weak moves a longer future can be considered. Unfortunately, the rule for eliminating bad moves is most difficult to discover.

The problem facing designers of chess playing machines was an interesting one. They had two approaches--one is easily implemented but rather wasteful, and the other is very efficient but extremely difficult to implement. A Russian grandmaster and electrical engineer named Mihail Botvinnik has spent considerable effort in trying to develop an algorithm for chess which is based upon the second principle. Central to Botvinnik's algorithm is the concept of "horizon." At each half-move point the computer generates a mathematical "map" of the chess board. The horizon limits the area of the map scanned by the computer much as natural boundaries limit our horizon. "The horizon is the boundary of the region containing those pieces, and only those pieces, that can take an active role within the given limits of time for movement. ... An attack falling within the horizon is included in the mathematical calculations--otherwise, it is not."

Rather than having the machine calculate all positions and eliminate some very early, Botvinnik has developed a means by which the machine's perceptual system is designed to immediately eliminate (by not perceiving it) trivial information. This, of course, should greatly increase the depth to which moves within the horizon may be considered. Some sort of perceptual screen is important even in dealing with problems in which all information is, at least to some degree, relevant.

A less rigorous example of the importance of the observation interface can be taken from U.S. experience in Viet Nam. Ellsberg describes the usual Viet Minh and Viet Cong response to increased U.S. military intervention:

> After suffering initial setbacks they would lie low for an extended period, gather data, analyze experience, develop, test, and adapt new strategies, then plan and prepare carefully before launching them (1972, 120).

The U.S., however, monitored "enemy" strength through its field commanders who in turn equated frequency of enemy contact with enemy strength. If the enemy is strong, the reasoning went, then it will fight. If it is quiet, then it must be weak. Based on these reports, the tendency was always for the President to view his policy changes as a "success." However, the U.S. observation interface was bad. Decreased contact did not mean a weakened enemy and, indeed, the periods of greatest crisis came at the times of highest U.S. optimism.

Included in this notion of an observation interface is, of course, some sort of social indicator system. Since no government can observe everything directly, it must develop some aggregate measures of performance in various areas.

As important as the observation interface is the access interface. How can actors in the government get their policies into the outer environment? There must be some structures involved with implementation.

Finally, the design theorist must develop means of characterizing various mechanisms and their effectiveness. How can the effectiveness of a particular mechanism be measured? I would think that here we are interested the competency of a mechanism to achieve certain goals in a particular class of outer environments. Competency, is not something that can be observed (though, of course, performance can). Indeed if the class of outer environments is restrictive, it is often possible to increase performance at the cost of decreased competence. Thus an important task for the theorist is to develop a way of characterizing the competency of a particular mechanism. My guess is that any definition of competency will be contingent upon the outer environment. A particular mechanism may be very competent over one range of environments and much less so over others. Therefore, in designing mechanisms, we must either have good estimates of future outer environments or else build in an effective self reorganizing capacity

At any rate, it seems to me that the development of design theory may well be a most exciting and important area for the theoretician. For it is this area which is, in my opinion, most lacking in concepts and programmatic guides to research.

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